

Amendments to the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

91 1. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate; and

forming a metallic glass coating on the substrate, the forming comprising forming a successive buildup of continuous layers, the metallic glass coating ~~and~~ having a first hardness of at least about 9.2 GPa, and ~~wherein the metallic glass comprises~~ comprising an alloy containing fewer than 11 elements.

2. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate;

forming a metallic glass coating on the substrate and having a first hardness of at least about 9.2 GPa, the metallic glass comprising fewer than 11 elements; and ~~The method of claim 1 further comprising~~ converting at least a portion of the metallic glass coating to a crystalline material having a nanocrystalline grain size and a second hardness of at least about 9.2 GPa

3. (Original) The method of claim 2 wherein the substrate is a metallic material.

4. (Original) The method of claim 2 wherein the substrate is a ceramic material.

5. (Original) The method of claim 2 wherein the first hardness is at least about 10.0 GPa.
6. (Original) The method of claim 2 wherein the metallic glass comprises fewer than 7 elements.
7. (Original) The method of claim 2 wherein the metallic glass coating is applied to the substrate as a plasma spray.
8. (Original) The method of claim 2 wherein the forming the metallic glass coating comprises an application of an atomized powder of a metallic glass material over the substrate.
9. (Original) The method of claim 2 wherein the forming a metallic glass coating comprises forming a successive buildup of continuous layers.
10. (Original) The method of claim 2 wherein the converting comprises heating the metallic glass to above a crystallization temperature of the metallic glass.
11. (Original) The method of claim 10 wherein the heating comprises heating to a temperature of at least about 600°C and below a melting temperature of the metallic glass.
12. (Original) The method of claim 2 wherein the second hardness is at least about 10.0 GPa.



13. (Original) A method of forming a hardened surface on a substrate, comprising:
providing a substrate;

forming a metallic glass coating on the substrate; the metallic glass comprising one or more materials selected from the group consisting of $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$, $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$, $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$, $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$, $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$, $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$, and $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$; and

converting at least a portion of the metallic glass coating to a crystalline material having a nanocrystalline grain size.

14. (Original) The method of claim 13 wherein the metallic glass coating is applied to the substrate by a plasma spray system.

15. (Original) The method of claim 13 wherein the forming the metallic glass coating comprises an application of an atomized powder of a metallic glass material over the substrate.

16. (Original) The method of claim 13 wherein the forming a metallic glass coating comprises forming a successive buildup of continuous layers.

17. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$.

18. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$.
19. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$.
20. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$.
21. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$.
22. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$.
23. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$.
24. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$.
25. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$.

26. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$.
27. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$.
28. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$.
29. (Original) The method of claim 13 wherein the metallic glass coating of comprises $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$.
30. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$.
31. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$.
32. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$.
33. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$.

34. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$.
35. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$.
36. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$.
37. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$.
38. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$.
39. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$.
40. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$.
41. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$.

57

42. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$.
43. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$.
44. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$.
45. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$.
46. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$.
47. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$.
48. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$.
49. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$.

9;

50. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$.

51. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$.

52. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$.

53. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$.

54. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$.

55. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$.

56. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$.

57. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$.



58. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$.

59. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$.

60. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$.

61. (Original) The method of claim 13 wherein the metallic glass coating consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$.

62. (Original) The method of claim 13 wherein the metallic glass coating comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$.

63. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$.

64. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$.

65. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 comprises $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$.

91

66. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$.

67. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists of $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$.

68. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 comprises $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$.

69. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$.

70. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists of $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$.

91
